Chapter 7

Technical Information Systems (TIS)

TECHNICAL INFORMATION SYSTEM (TIS)

Urs A. Herzog / Felix Fehr
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1. INTRODUCTION

Since a few years the cement industry is under continuous pressure to optimise their production in general. One reason is to lower production cost, another is to minimise the use of energy and fulfil the emission limits of new environmental protection legislation. Also cement market asks for new products and product properties, therefore production modification and expansion must be realised in short time.

To be able to act and react to this continuous challenge, management and personnel responsable of plant operation must have access to the relevant information about their production, and production equipment.

Beside the three classical production resources: manpower, capital, real estate, predictions are that information will soon be the forth.

Therefore Information Management Concepts and tools which support the user to get and analyse this information, are getting more and more important:

This paper gives an overview of modern Process Information Management, of available Information Systems and some experience of applications of such Information Systems.

2. PROCESS INFORMATION MANAGEMENT

2.1 Introduction to the Improvement Process

Market competence and changing regulations forces company and plant management to optimise continuously the cement manufacturing process to increase production, improve the equipment performance, reduce the use of energy, reduce the amount of necessary man-hours, in summary lower the overall production cost of our product the cement.

In general, optimisation and improvement is based on the following facts: (according Jim Harrington).

- **If you want to improve it, you have to control it !**
- **If you want to control it, you have to understand it !**
- **If you want understand it, you have to measure it !**

The three activities: measurement, understanding (to analyse data and to come to a conclusion) and control form together the **Improvement Loop**. Improvement is only sustainable if this improvement loop is executed continuously.

Corporate programs as BCM or MAC fully relay on this improvement loop (e.g KPI measurement, reporting, action meetings, etc.).

Nowadays (since the invention of modern computers) some of Improvement Loop tasks can be executed automatically. The most time consuming and boring task of process data acquisition, raw data handling and report compiling can be done with a computer system. Plant personnel can be used for analysing information and for decision making. – This is a more adequate challenge for a human being than coping numbers.

2.2 Importance of information for decision making

The basis for management to make the daily operational and the medium term tactical decision, is information. Information coming from the process and process related actions as quality control, dispatch, emission monitoring and others.

If the plant or company management want to act - proactively or reactively - they need information. The more they fine tune the operation (e.g: BCM) and the more they optimise the risks (e.g: MAC), the more comprehensive, reliable, accurate and direct must the information they base there decisions on be.

A modified quotation from a Japanese Business Expert (name unknown) says it quite direct:

Information is a key success factor for business
some Managers know this
others are learning
the rest will be Victims.

2.3 Process Information which is relevant for plant performance improvement

For the daily plant operation, as well as for medium and long term plant performances monitoring and improvement the different responsibilities in a plant need the following type of information on hourly, day, week, month and year basis.:

Company / Plant Management	• What is the plant performance this day / week / month / year? • Where is the biggest improvement potential? • How are we compared to the others (benchmarking)
Production	• What is the production rate, consumption, actual stock of materials?
Process	• Does the process / equipment runs optimal? - Why not?
Maintenance	• What are the equipment runtimes, machine conditions, failures rates? - Failure reasons?
Quality	• What is the quality level of our product? Why is it in / out of specification?
Energy	• What are the specific energy consumption? - Tendencies?
Environment	• What are the emissions? Are we endangered to exceed limits?

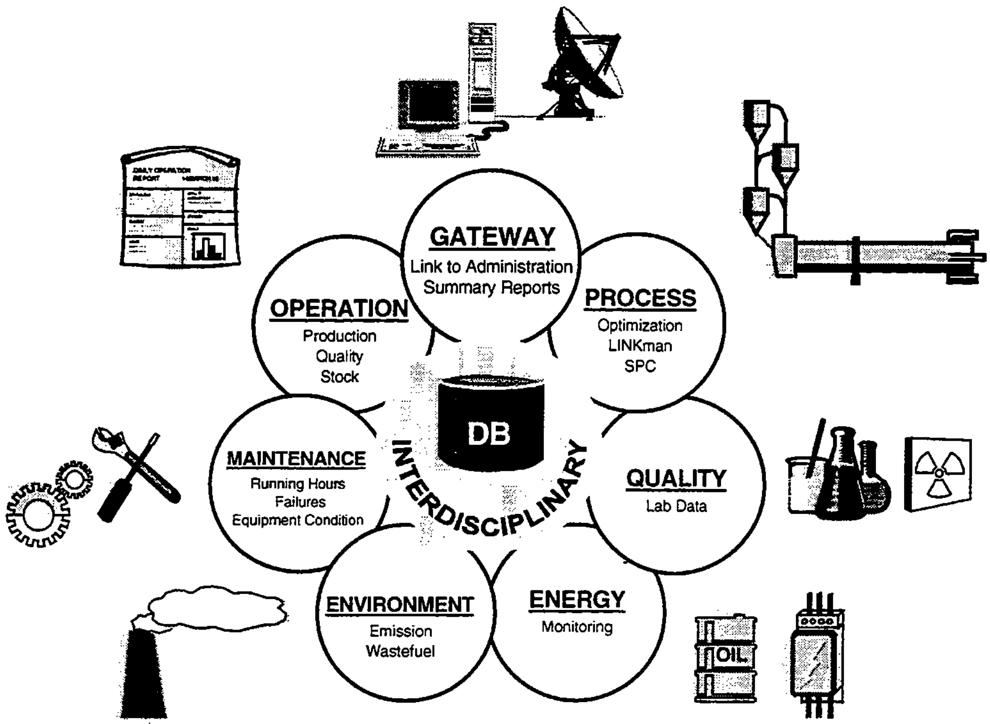
In more general terms, the plant personnel needs a tool which provides:

- Relevant Information
  - at the **R**ight Time
  - at the **R**ight Place
  - in the **R**ight Form
  - to the **R**ight People

  This simple but important statement (from: Rauli Hantikainen) describes the basic requirement of adequate Information Management.

  A computer systems which can fulfil the above mentioned requirements has to be based on a integrated Database incorporating data sets from all technical related plant disciplines:

Figure 1:



Such system are called: "Technical Information System".

3. TECHNICAL INFORMATION SYSTEMS (TIS)

In the past, most of the management's planning and optimisation was based on different data printouts, recorder charts and manually generated reports. But nowadays tools and system concept are available to get immediate and accurate information on there desk top in seconds.

3.1 Types of Automation- and Information System in a plant, Definitions

In this paper common industry term as CIM- and ERP- System are used. They are indispensable for describing and defining the architectures and system concepts that are involved in plant wide Information Management system solutions. Their definition is found just below:

- CIM = Computer-Integrated Manufacturing systems:

A series of computer-based systems, both business and technical, integrated into a single conceptual solution. A CIM system is comprised of components and elements of both ERP and TIS systems (see next), as well as the different automation systems like process control, high level control, quality control (lab), etc.

- ERP = Enterprise Resource Planning system:

A integrated, networked computer system providing (primarily) business functions and some manufacturing functions. An ERP system mostly provides also the information link between the company headquarters (HQ) and the plant. In most "Holderbank" Group Companies the product SAP R/3 is implemented (or planned) as a ERP system.

- TIS = Technical Information System:

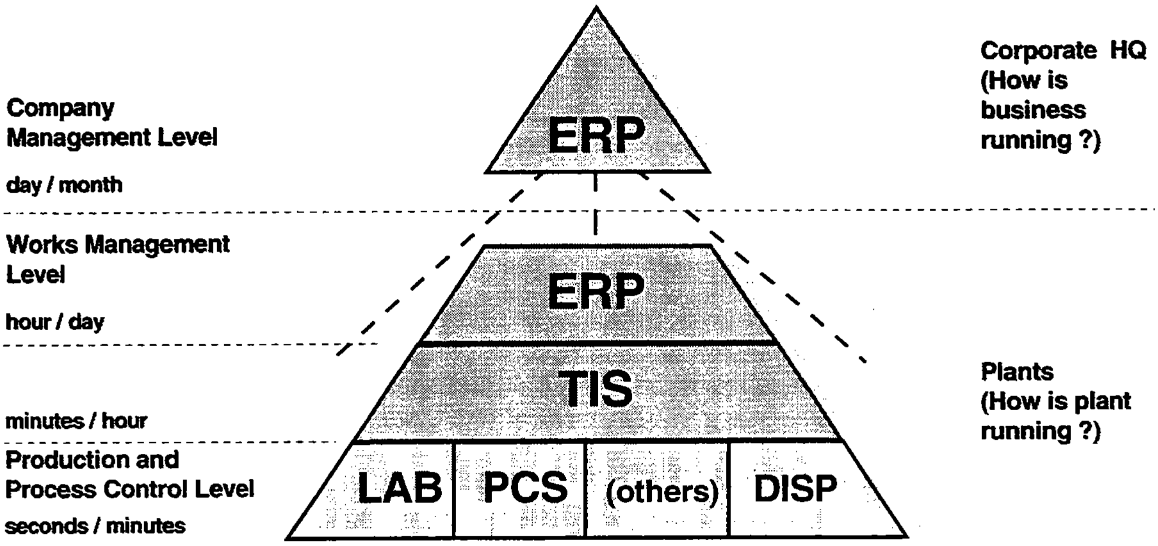
A integrated, networked, real-time computer systems providing (primarily) manufacturing functions. Its real-time data base technology merge all plant automation data with data from the non-technical (or business) systems within a Plant. By capturing "live" information about the manufacturing process as, sensor measurement, set-points, run-times, throughput, yields, etc., a TIS can measure constraints and identify bottlenecks to better manage and control manufacturing processes (see also decryption in chapter 3.2).

(In some industries the term MES, Manufacturing Execution System, is uses also).

The sketch below shows the structure and interactions of the different mentioned systems.

Figure 2:

Computer-Integrated Manufacturing (CIM) Systems - Hierarchy



Legend: CIM = Computer-Integrated Manufacturing (system); ERP = Enterprise Resource Planning; TIS = Technical Information System; LAB = Laboratory Information System; PCS = Process Control System; (others) as EMS = Emission Monitoring System and HLC = High Level Control Systems; DISP = Automatic Dispatch System

3.2 Principle of a Technical Information System (TIS)

3.2.1 General

In the CIM pyramid, a TIS is locate between the Company / Works Management Level (ERP) and Production / Process Control Level (Plant Automation). The interaction between those levels is as follows:

- The tactical and strategic decision are made in the higher levels:
  - The computer systems on these levels must provide to management business data and compiled and summarised plant information (process, production, equipment and quality) (time range: days, month, years).
- Operation of the plant is done from the lower level systems.
  - The computer systems on these levels must provide to plant responables immediate accurate real-time process and process related information. (time range: seconds to hours).
- A TIS System does the automatic data acquisition and data pre-processing. It provides tools for data evaluation, create reports, graphs and tables, for status and performance analysis. It also serves as a data interface between Operation and Managing Level of a plant and company.

3.2.2 Tasks (requirements) of a TIS

Data Acquisition

Data from the process and process related tasks, e.g as material handling, product shipment and quality determination is the basis for compiling the above mentioned information. In a up-to-date cement plant most of this data are already automatically measured by a computer based Process Control System (PCS) and other Automation systems (High Level Control, Lab, Dispatch, Emission, etc.). In a standard set-up of a 3000 to 5000 tones per day plant, the PCS measures and handles roughly 600 analog sensor, 600 counters and integrators and up to 15'000 alarm and event messages. Data acquisition, data processing and visualisation is done in real time (milliseconds to seconds). Historical data is normally presented to the operator in graphic trend charts and data historian is stored for playback for up to a week, sometime month. The PCS capability is very limited for tasks, as long term data storage and retrieval, history archiving, data consolidation and report generation. Furthermore data from the lab analyser and dispatch system are normally not interfaced to the PCS. Data acquisition scan time from data of all above mentioned automation system is between 10 to 60 seconds.

Data Pre-Processing, Storage and Archiving

All the automatic read in data, is filtered and pre-processed according data type (e.g. integration of a kW signal to kWh, conversion of silo distance measurements to silo level, combination of a cement type signal and a material flow signal to a amount of finish good produced, calculation of specific fuel consumption out of heat content, flow of fuel, kiln feed and clinker factor etc.).

The different type of scanned and calculated values are then stored in integrated, real-time Database. The data storage structure is optimised for a huge amount of data to be read and retrieved in very short time. Archiving and retrieving to and from a tape or disk unit must be possible under on-line conditions. Raw data lifetime on harddisk is normally 6 to 12 month, on tape between 1 to 10 years (in some special cases as emission data for the EPA, archive data lifetime, must be guaranteed for up to 30 years).

Especially a fast and user-friendly data retrieving engine is important. Otherwise the data is buried in a Data Graveyard with no use at all. A short estimate of the total amount of data on such a system emphasise the importance of this statement:

- Scan time = 1 minute, analog measurements = 1200 tags, amount of alarm and event messages (132 char.) per minute = 1 data lifetime (on disk) = 1 year.
- (4 Bytes per number, 1 Byte per character, 4 Bytes per message)
- per minute: ==> (1200 * 4) + (132 * 1) + 4 = 5000 Bytes
- per day: ==> 60 * 24 * 5000 = 7.2 Mbytes
- per year: ==> 365 * 7.2 MB = **2.6 GB (Data Storage Capacity)**

Data Evaluation

To analyse this big amount of data it is indispensable to applies specific methods and tools to transfer the raw data to useful information (remember the difficulties to analyse the pyro-process with data on multiple, endless paper charts strips with no physical scale, date, and remarks on it).

A state-of-the-art TIS provides most of the following Data Analysis and Reporting tools:

- Plant Overview Display
  - Gives plant management an immediate overview over actual plant- and equipment-operation.
- Daily / week / month / year Manufacturing Report
  - Summary Report with information about the process, production, equipment status, material stock, quality, shipment etc.. Medium and long-term performance monitoring.
- Operation Log Reports:
  - Short term production and process performance monitoring
- Trend graphs
  - Actual - and historical process status and performances
- Alarm List and Alarm Statistic
  - Shows actual and historical equipment failures and gives maintenance personnel an overview of equipment problems.
- List of running hours, production numbers and process values
  - Enables plant personnel to plan production and maintenance schedules; For special situations also Ad-Hoc analysis can be done and special Reports (Emissions for EPA, ATR for "Holderbank", etc.) can be created.
- Statistical Analysis as Charts, Correlation, Pareto
  - For Quality control, process optimisation and maintenance support.

Manual Data Entry and Data Modification Capability

For the calculation in the pre-processing (see above) the TIS needs manual entered plant constant. Examples of such plant constants are: clinkerfactor, raw material humidity, head content of fuels, etc. A TIS must provide user-friendly functions to enable plant personnel to adjust the constants in a easy way.

Furthermore, a TIS must provide functions to modify and adjust calculated and integrated report values. In contrast to booking numbers in a transaction based ERP business system, every physical sensor measurement has a measurement error (independent how often the sensor has been calibrated). Integration of sensor values result in accumulation of the error. For example in a 2 million tonnes per year cement plant, a 2% error in the produced cement belt weigher system, results in a divergence of 40'000 tonnes of cement. TIS applications showed that automatic generated reports must be checked for plausibility and adjusted accordingly before they can be approved for further use (e.g. as input data for a SAP, ERP system).

Interfaces to Automation- and ERP System

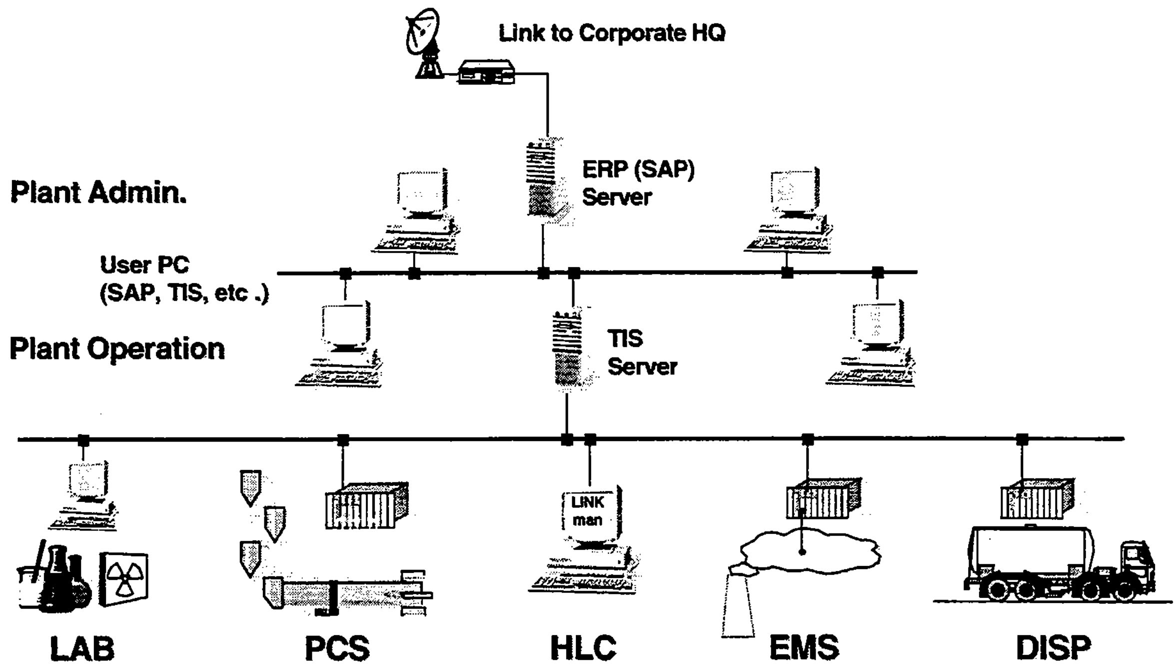
As shown in chapter 3.1, a TIS System is located in between the ERP business system of company / works management level and the automation system of the process / production control level. This means a TIS reads his input data from one or multiple automation system as Process Control System, Lab System, Emission Monitoring System etc.. Compiled reports can be sent to the upper level ERP System for further treatment. A TIS supplier must provide and support highly reliable interfaces to different brand of automation- and ERP systems.

3.2.3 Structure and Integration of a TIS

The general structure of a TIS and the integration in the plant information management concept looks as follows:

Figure 3:

Structure and Integration of a TIS



With this approach, the process related data flows in a structured flow from bottom to top. All systems are networked, manual data entry is minimised, data transfer speed and data quality are maximised.

What to avoid

In some plants ("Holderbank" and Non-"Holderbank") the automation- and control systems as well as different business computer systems were installed over several years not applying an overall concept.

This "natural grown" computer system agglomeration are typical patchwork solutions with individual computer islands (not using standards).

Such systems are highly complex, difficult to document and maintain and result high operation and support costs. The flow of data is limited, because too many systems and interfaces are necessary. Often manual data transfer is used (data printout of one computer system, data entry typing in the other computer). Such approaches are not user friendly, show slow data transfer, low quality of data and redundant data sets and results in user frustration.

3.3 TIS Systems and Suppliers

The results of different Industry Market Scan (1993 - 1997), executed in co-operation with "Holderbank" Group Companies in various countries, are summarised below. The list shows suppliers, product names and country of origin:

Supplier	Product	Origin
ABB	CIMS	Switzerland
Siemens	CEMAT-MIS	Germany
AspenTech	CIM/21, InfoPlus.21	USA
FLS / Fuller	Plant Guide	USA / Denmark
OSI	PI System	USA
Honeywell	Uniformance	USA

4. TIS APPLICATIONS AND EXPERIENCES

4.1 TIS System installed and planned in "Holderbank" plants

4.1.1 System installed and running

Company / Plant	Country	TIS Supplier / System	Installed
AB GmbH / Lägerdorf	Germany	Siemens / CEMAT-MIS	1994
BCU / Untervaz	Switzerland	ABB / CIMS	1995
HOLNAM / Holly Hill, Clarksville, Dundee, Artesia	USA	AspenTech / CIM21	1995/96
Alpha / Dudfield, Ulco	South Africa	ABB / CIMS	1997/98
HOLNAM / all 15 plants (cement and slag)	USA	AspenTech / InfoPlus21	1997/98

4.1.2 System planned to be installed (Project approved)

Company / Plant	Country	TIS Supplier / System	planned
HCB / Siggenthal	Switzerland	ABB / CIMS	1998/99
SCL / Chekka	Lebanon	under Evaluation	1998
QCL / Gladstone	Australia	under Evaluation	1998/99

4.2 Some Specific Applications and Experiences, Benefits

4.2.1 Alsen Breitenburg Zement - und Kalkwerke GmbH, Lägerdorf, Germany

(Main use of TIS: Process Analysis, Quality Monitoring, MAC report data)

Cement plant with 2 kilns, with a capacity of approximately 1.6 mio t/y cement.

The company sells more than 34 different types of products and has to keep track of all the sales and quality of the products. Furthermore the new kiln 11 is designed to be feed with numerous alternative raw materials and fuels.

TIS System implemented: **Siemens CEMAT-MIS**

- ♦ Technical Concept
  - Siemens CEMAT-MIS Technical Information System installed in 1994
  - The system uses a Server based on a PC (Intel Pentium) running Siemens proprietary DBMS and PC Clients running MS Excel for reporting and data analysis.
  - Trend display and analysing tool (extended analysis possible on integrated Excel tool)
  - Use standard production, operation reports and custom defined daily production report (realised on Excel).
  - Reads process and production data directly from the Process Control System (PCS = Siemens CEMAT Coros LSB / S5). Reads approx. 2000 analog values and process more all alarms and event messages, scan rate = 1 minute).
  - Quality data from the automatic, roboterised lab system (Polysius POLAB) are feed via interface directly to the CEMAT-MIS (event driven).
  - Data from the Emission Monitoring system are send to the CEMAT-MIS via interface.

- The CEMAT-MIS reads dispatch and sales data once per day from the company mainframe via ASCII file transfer.
- All systems are connected via an Ethernet LAN (H1 and TCP/IP protocol).
- Integrates production, operation, quality, emission and consumption monitoring and reporting.
- More to 16 user PC's.
- Reports on the plant files server (Novell) can be transfered via modem lines at the terminal and grinding plant locations.

♦ Experiences / Benefits

- The CEMAT-MIS is a very reliable and adequate performing system (more than two years of experiences).
- The excellent trending and reporting features provided a tool to analyse and optimise the process easy (for example the ball mill charges). Advantage: TIS calculate the specific energy consumption for each type of cement individually. With this cement type dependent energy consumption trends can be monitored which is only possible with automatic data acquisition and pre-processing via PCS and TIS.
- The CEMAT-MIS was directly used for the commissioning of the new kiln 11. The long-term data storage and trending function provided a excellent tool to speed up commissioning. It even prevented the plant to pay the cost for a damaged EP Filter, because with the data from the CEMAT-MIS the engineers were capable to find the root-cause and the exact time when the damage happened. So repair cost could be turned over to the suppliers insurance.
- Tailor made reports for the MAC Initiative provide automatically, on daily basis the necessary production- and equipment efficiency- numbers. This data were used to calculate the KPI (Key Process Indicators) and are the basis for failure analysis. The biggest benefit from the system is fast and automatic report generation every morning (sustainable). Data accuracy with this system is much better than manual data processing and saves up to 3 man-hours per day.
- Complex process analysis realised with correlation charts provide new perceptions, which help to increase production equipment efficiency.
- System is very well accepted and used by plant personnel.

♦ Further Proceeding and Projects

- In 1998 a SAP R/3 ERP System will replace the now used mainframe system.
- An interface for data exchange between the SAP R/3 and the Siemens CEMAT-MIS systems is foreseen. The planed use of this interface is to transfer form the TIS failure reasons and equipment running hours in the SAP Plant Maintenance Module (PM). A study will check the possibility to use the SAP Production Planning Module (PP) with production numbers from the TIS.

4.2.2 Buendner Cement AG, Untervaz, Switzerland

(Main use of TIS: Emission Reporting, Overall Manufacturing Report, Energy Reporting).

Cement plant with 2 kilns with a capacity of 1 mio t/y cement.

TIS System implemented: **ABB CIMS**

- Technical Concept
  - ABB CIMS Technical Information System installed in 1994/95.
  - Reads process and production data directly from the Process Control System (PCS), realised with an Allen Bradley PLC 5 and PC based HMI system (reads approx. 600 analog values and process up to 15'000 alarms and event messages, scan rate = 1 minute).
  - Integrates production-, operation, consumption and emission monitoring and reporting.
  - Trend display and analysing tool (extended analysis possible on integrated EXCEL tool).
  - CIMS is a Server / Client solution based on DEC Alpha server running a Oracle DBMS and PC Clients running MS Access and Excel for reporting and data analysis.
  - Use standard production and operation reports and custom defined emission report (realised on Access).
  - CIMS can consolidate (and compress) data to hour, shift, day, month and year values and stores data for on-line access up to 1 year.
- Experiences / Benefits
  - Improved and faster monitoring and reporting of emission data to EPA.
  - Tool to analyse operating and emission data which improved the use of HWDF burning.
  - Reduced drastically the man-hours (up to 2 man-hours daily) needed for manual data entry and manual analysis to generate emission and production reports.
  - A sophisticated Overall Manufacturing Report provide on daily and monthly basis a summary of key process, production, consumption, efficiencies, stock and quality data. Saves production management up to 0.5 man-hour daily.
- Further Proceeding and Projects
  - Expand CIMS for enhanced production reporting and detailed electrical consumption reporting.
  - An interface for data exchange between the SAP R/3 and the ABB CIMS systems is foreseen (flow of material, equipment runhours and condition).
  - Adapted reports for support for MAC Initiative.

4.2.3 Holnam: Holly Hill, Clarksville, Dundee, Artesia; USA

(Main use of TIS: Emission Reporting, Process Analysis).

Four Cement plants which burn HWDF (Hazardous Waste Derived Fuel). Legislation force them to monitor emission (based on gas analyser and materiel input model calculation).

TIS System implemented: **AspenTech CIM21** (former company: ISI)

- Technical Concept
  - AspenTech CIM21 Technical Information System installed in 1995 and 1996
  - Reads process and production data directly from the Process Control System (PCS), realised with a Modicon PLC and Gensym G2 based HMI systems (reads approx. 200 - 330 analog values per kiln, scan rate = 1 minute).
  - Integrates emission monitoring and reporting.
  - Trend display and analysing tool (extended analysis possible on EXCEL tool).
  - CIM21 runs on UNIX based HP workstation server. The Database is proprietary. PC (under X-Window) can be used as user interface.
- Experiences / Benefits
  - Provide the mandatory (according EPA) emission monitoring, reporting and data archiving.
  - HWDF burning would not be possible without this TIS systems.
  - The system is also used for process data analysis (mainly graphic trend) because trending features of the used PCS are not sufficient.
- Further Proceeding and Projects
  - Upgrade the existing CIM21 system with the new InfoPlus21 (NT based Client /Server System).
  - Install in the remaining 11 plant a InfoPlus21. Use mainly as process data historian and emission monitoring tool.
  - The company wide "Manufacturing Data Integration" (MDI) project will integrate these TIS in the ERP Datawarehouse (Holnam proprietary Data Management System based on Oracle).

5. TYPICAL PROJECT SCHEDULE AND SCOPE OF SUPPLY

5.1 Project Schedules (typical)

The introduction of a TIS system needs some pre-project investigations resulting in a detailed specification. With this, an evaluation (bidding process) can be executed to find the most appropriate TIS. Normally a TIS is implemented in steps, similar to a SAP, realising the functions with the highest priorities first. The following schedule gives some indications of the whole procedure.

Phase	Actions
0: Pre-condition	The plant must be equipped with a state-of-the-art computerbased Process Control System (PCS).
1: Study	Investigation study to determine plant requirements, elaboration of a concept. Investigate integration in plant /company computer infrastructure. Check of interface solutions to all automation systems and to the ERP system.
2: Project Planning	Creation of a Specification and elaboration of a budget and an implementation schedule.
3: Tendering and Evaluation, Offer	Creation of a tender document. Execution of a system evaluation and selection of a System / Supplier (in some case evaluation can be skipped if a company standard exist). Ask for offer (using specification and schedule).
4: Implementation of Step 1	Implementation and commissioning of TIS basis System. Check of performance, adaption of functions to meet plant requirement, (if necessary).
5: Implementation of Step 2	....

5.2 Scope of supply (typical)

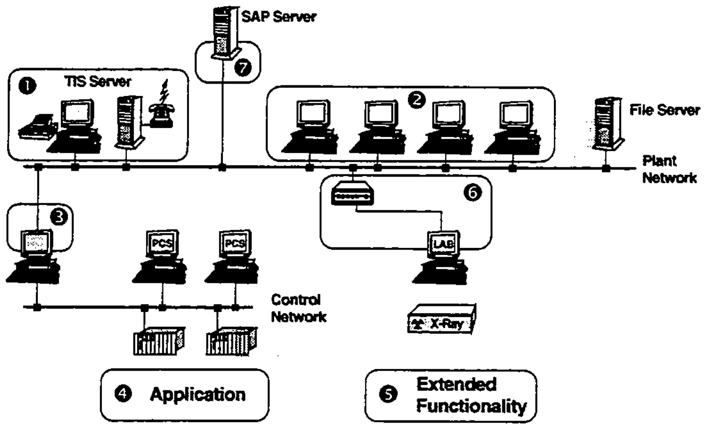
The scope of supply of a TIS application may vary from plant to plant, as the requirements are different.

Nevertheless there are basic requirements in a typical cement plant that can be satisfied (usually in a first implementation phase). That is why the scope of supply is roughly divided into Basic System and Options. The experience shows, that a cost estimation cannot be given at this place, because functionality, interfaces and numbers of users differ from project to project. But it is important to know, that project costs are higher than system costs, because time and cost intensive tasks (study, specification, evaluation, see schedule in 5.1) must be done prior to the system implementation.

The following sketch gives an overview of different packages of a TIS basis system (1...4) with options (5...7).

Figure 4:

TIS Scope of Supply (typical)



TIS Basis System (for reference see number in sketch)

1) Server Hardware (HW) an Software (SW), TIS basis SW including DataBase
2) 4 User PC SW license for basis data evaluation
3) Interface driver SW for data acquisition from a Process Control System (PCS)
4) Application applying standard reports and evaluation methods, including system installation and user training

TIS System Options (for reference see number in sketch)

5) Extended functionality as Maintenance Support Functions, SPC, plant specific Manufacturing Reports, etc.
6) Interface to Lab or Dispatch (weighing) system
7) Interface to SAP System, including data exchange concept
   a) Hardware is part of the plant computer infrastructure
   b) not included is set-up and configuration on interfaced system

Assistance from HMC/HES

HMC offers its assistance and experience for TIS Implementation in a plant or group:

- audit
- elaboration of (detailed) specifications and tender documents
- evaluation of offers from different suppliers
- general project assistance
- detailed engineering of reports (optional)
- training for plant personel (optional)
- performing aceptance tests

6. RESULTS AND CONCLUSION

6.1 Results, Benefits

The Experience and results from different Process Information Management Projects in the cement and other basic industries show the following benefits:

- **Fast and accurate information**
  - Fast and accurate information enables the plant management to see tendencies and to react and direct measures before limits were exceeded. Because reports were calculated automatically, response time is hours or days, **not month.**
- **Open information exchange**
  - All managers which use any kind of integrated Information Management System (not necessary a TIS) confirm that such tools enables open information exchange which improves teamwork drastically and minimises mistrust. This because every user has access to the same information. People share information and work closer together.
    In projects were an interface between the ERP System (e.g. SAP R/3) and the TIS are planned, personnel responsible for the process and administrative personnel form an interdisciplinary team, were both sides start to understand also the problems and the requirements of "the other side".
- **Indispensable for sustainable optimisation**
  - High sophisticated Optimising System as LINKman High Level Control need to be fine tuned and adapted to changing process conditions. Only continuous monitoring of the performance and process conditions with specific analysis tools, as Correlation's, prevent from decreasing system performance.
    In one plant the LINKman runtime can be maintained continuously over 95% with the help of daily performance feedback, which allows immediate reaction to arising problems.
    Permanent monitoring of key parameters and adapted analysis methods like Statistical Process Control (SPC) provides vital information about equipment status and equipment failures. Maintenance Improvement procedures (like the one in MAC) relay on such type of feedback data.
- **Fulfil legislation requirements**
  - Legislation forces us to monitor, analyse and report certain critical values. (e.g emission, use of waste fuel). In USA (BIF) and Switzerland (TA Luft) monitoring, reporting and data archiving of emissions and waste fuel with a TIS, were accept by the local EPA's.
  - Continuous Quality monitoring of shipped cement (e.g.: Germany: Cement Norm VDZ, USA: Mill Certificate) can be realised with the help of a TIS.
- **Saves man-hour**
  - In all plant using a TIS, plant management claim man-hour savings. But the even bigger advantage is, that a TIS frees the engineers from formal work (like data entry, manual data processing) and allows him to use more time on the data analysis.
  - Studies of TIS applications in different basic industries show:
    - Reduced data entry time: 75%
    (reports are compiled in 3 minutes, and checked in 5 minutes)
    - Reduced Paperwork: up 50%

6.2 Conclusion

Considering the importance of relevant information, the actual trends in Information Technology, the indications we have from Technology Watches of non-cement and cement industries (our competitors) and the experiences from TIS and SAP applications result in the following conclusions:

- A competitive optimised plant has to be based on computerbased, integrated Information Management System (according CIM concept).

Process Information Management with a TIS is a central pillar of such an "Integrated Plant". Individual users are empowered at the desktop. Process Data feedback and intelligent use of this information is indispensable for a continuous improvement process and will help the plant to be competitive.

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